knowledge of the present day must be put into simple form for the use of the children of the next generation, in order that they may have time to acquire the higher or advanced knowledge that will have to be taught fifty years hence; just as we now teach in the high school that which was appropriate for the university in the days of Galileo and Newton.

METEOROLOGY IN THE UNIVERSITIES.

For many years Prof. William H. Brewer, of Yale College, has delivered courses of lectures on meteorology in the Sheffield Scientific School. The third edition of the syllabus of lectures was published in December, 1896; a fourth edition dated September, 1899, has lately been received. In this edition 13 lectures are enumerated, covering 190 topics, whereas in the third edition, 15 lectures and 206 topics were given. Some of these topics are merely referred to in the lectures, but are introduced in logical order as suggestions to those students who wish to pursue the subject farther. The titles of the 13 lectures are as follows:

I. Introduction.
II. The Atmosphere.
III. Temperature.
IV. Pressure.
V. Winds and Circulation.
VI. Atmospheric Moisture.
VII. Condensation of Atmospheric Moisture.
VIII. Cyclones and Anticyclones.
IX. Other Storms and Winds.
X. Rainfall and its Distribution.
XI. Public Weather Service.
XII. Atmospheric Electricity.
XIII. Optical Meteorology.

Since the establishment of the school of forestry at Yale College, Professor Brewer's lectures to the students of forestry have included, not merely the above course in meteorology, but also additional lectures on the relations of forestry and meteorology, including the following special subjects:

General conditions necessary to forests; elementary meteorology; forests as related to temperature and its range; to rainfall and its range; to excesses of weather and climate; to the mechanical and chemical nature of soil and groundwater; to the geological character of the surface; to the relief forms of the land; to other geographical features; the geographical distribution of forests; the aspects of forests as related to climate and topography; and the geological history of forests.

THE WEATHER BUREAU AND THE UNIVERSITIES.

It is difficult to fully record or realize the activity of the Weather Bureau officials in the matter of lectures on meteorology and cognate subjects. We are especially interested in lectures of a highly instructive character delivered to the students in colleges and universities and if the Editor sometimes fails to mention these in the MONTHLY WEATHER REVIEW, he hopes that the respective lecturers will promptly send him a memorandum for publication.

Several lectures have been delivered from time to time by Mr. Charles Stewart of Spokane, Wash.; the last in his series was that delivered on February 24 for the faculty and students at Gonzaga College. The address was illustrated by means of four large charts prepared by Mr. Stewart, who spoke upon the utility of scientific weather observations. Before concluding, Mr Stewart gave replies to questions put by his hearers, whose appreciation was evinced by hearty applause.

A course of five lectures on advanced meteorology was delivered before the students in mathematical physics, at the Johns Hopkins University, May 7–11, 1900, by Prof. F. H. Bigelow of the United States Weather Bureau, on the following topics:

1. A new method of deducing the general equations of motion on the rotating earth.
2. The treatment of the aqueous vapor in barometric and thermodynamic problems.
3. Application of this discussion to the theory of the formation of clouds.
4. The Ferrel and the German types of circulation in the general and the local cyclones.
5. The results of the international cloud observations in the United States, and their indications regarding the circulation of the atmosphere.

The series of lectures on meteorology delivered by Dr. O. L. Fassig, at the Johns Hopkins University, by permission of the Chief of the Weather Bureau, came to a close on March 17, and we make the following extracts from his report on the subject:

> The character of the series was somewhat changed this year. In place of the regular University lectures to a small number of students, the series was placed in the public educational course inaugurated by the University last year. This made it necessary to put the lectures into more popular form; at the same time the size of the class was greatly increased. Last year the class consisted of 7 or 8 University students; this year it comprised about 80 public school teachers and principals and 5 University students. The regular course consisted of 15 class lectures, covering the general subject of meteorology and climatology and the work of the United States Weather Bureau. A supplementary course of 6 lectures was added; in this course I had the generous cooperation of Professor Abbe and of Mr. Walz of the Weather Bureau and of Mr. Page of the United States Hydrographic Office.
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> The period covered by the courses was from January 6 to March 17, 1900, 2 lectures being given each week. Attendance was free to University students and to members of the local office of the Weather Bureau. From others of the class a subscription of $3 was required for the course. An additional fee of $2 was required of those receiving a certificate at the close of a successful written examination.[1]
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> The scope of topics treated may be seen from an inspection of the lecture outlines and illustrative diagrams submitted herewith. A detailed outline of each lecture was printed and given to members of the class. In addition to the printed outlines the chalk plate process was freely used in preparing diagrams to illustrate principles and conditions. The diagrams have given much satisfaction to members of the class, and have added greatly to a better understanding of the subjects treated. Judging from comments made by President Gilman, Dr. Clark, and members of the class, I infer that the course of lectures has given satisfaction.
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> The members of the class have shown much interest in the subject of meteorology and in the work of the Weather Bureau; it was a source of much encouragement to me to find this interest maintained to the end of the course.
>
> I have from time to time received requests from other members of the Bureau for copies of my lecture notes. Having spent much time and labor in the preparation of my outlines and diagrams, in addition to my notes, and thinking that they may be of some value to my colleagues, I have collected together a few sets like the pamphlet submitted herewith, and have sent them to those Weather Bureau officials who are engaged in similar work at other universities.

THE CLIMATOLOGY OF CALIFORNIA.

The reports of the California section are rich in valuable climatological data, thus: The number for April contains an article on the climate of Salinas, presumably by Mr. McAdie. The March number contains the summary, by Dr. A. K. Johnson, voluntary observer at that place, on the climatology of San Bernardino. The February number contains one on the climatology of Fresno by Mr. J. P. Bolton, observer, Weather Bureau, at that place. The January number has an article on the climate of Los Angeles by Mr. G. E. Franklin, local forecast official. Doubtless this excellent series will be con-

[1] These fees belong to the University.—C. A.

tinued by similar contributions from other parts of the State, and Mr. McAdie is to be congratulated on his success in stimulating the study of climatology throughout the great area over which he has supervision.

ISOTHERMS FOR A GIVEN ALTITUDE.

In drawing isothermal lines one's desire must be to present the temperature of the air so clearly that the reader may, at a glance, obtain a graphic and correct impression as to both relative and absolute temperatures. If we go only into the most general features of the distribution of temperature in the atmosphere and neglect the small differences that occur in what are called local climates, or if we consider the air far above the earth's surface as being of greater dynamic importance than that near the ground, then we may be content with isotherms depending upon a few observations at stations several hundred miles apart as in the general Weather Bureau telegraph system. But if we consider local climatology from an agricultural point of view, we must not only make use of an unlimited number of stations in every variety of location, as in our voluntary system, but we must also carefully consider the details of the topography of the ground and the methods of presenting the influence of topography upon temperature. For instance, imagine a valley surrounded by very gentle slopes attaining their summits ten miles away from the central depression; in such a valley, during clear nights, the air will settle into the depression and the minimum temperature at that point will be lower than on the summits ten miles away. If now we draw isotherms for surface temperatures only and display them on charts without showing the topography, the reader will infer that we have here a cold center and a warm circumference, and will expect to see the winds blowing outward in all directions, in a manner exactly contrary to what takes place during clear nights. On the other hand, during the daytime, the temperatures will be hotter in the central depression and cooler on the rim. The isotherms will show this fact and the observed winds will harmonize with the conclusion that the cool wind on the rim should flow toward the rising hot air of the center. The simplest way in which to present the details of temperature at the surface for comparison or study is by means of surface isotherms or temperatures in one color, printed upon a map that shows contour lines in another color.

The flow of water, or drainage, can be inferred from the contour map because the relation between the two is very definite and simple. Water will flow down grade, but the wind flows easily either up hill or down hill, according as the surface of the ground is heated by the sun or cooled by radiation. It is only during still nights that cold air flows down grade with the regularity of a water course.

If we give up all attempts to represent the details of temperature over a large and varied area like that of the United States, and present only the most general aspects of atmospheric temperature, such as the daily, monthly, and annual averages, we can do this in part by taking advantage of the fact that these average temperatures generally diminish with altitude above sea level, not indeed according to a uniform rate, but with rates whose variations, diurnal, annual, and local, are beginning to be at least approximately understood. We shall not go far wrong if we adopt the rule that the monthly mean temperatures at the Weather Bureau station throughout the United States diminish with the altitude of the station above sea level at the rate of 1.5° per 1,000 feet during December, January, and February; 2.0° during March, April, and May; 2.5° during June, July, and August; 2.0° during September, October, and November. This is not to say that the air temperature in the free air above the ground follows this law. On the contrary, the station temperatures are affected by the presence of the earth on which they stand; a plateau or mountain station has not the temperature that would be observed from a balloon in mid air at that altitude. Moreover, the above rates of diminution apply to the average temperature of the month, as affected by average winds and clouds, and may depart very far from the law that obtains during clear weather or calms. Thus it happens that each station has a special local correction.

If we now adopt these or similar mean monthly vertical gradients and reduce the surface means to a uniform level, for which the sea level is generally the most convenient, but a higher level is appropriate to plateaux applying local corrections when needed, we obtain the sea level isotherms shown on Chart IV of the MONTHLY WEATHER REVIEW. Such isotherms must, of course, not be considered as representing surface temperatures nor even the atmospheric temperatures that would prevail if the continent were reduced to a plain at a given level; they give us merely a convenient basis on which we may base a calculation as to what the mean surface temperatures were for any month and at a spot of any given altitude. For instance, the REVIEW for February, 1900, Chart IV gives a sea level temperature of 34° for Wichita, Kans., as computed by using a gradient of 1.5° per 1,000 feet. As the altitude of the Wichita thermometer is about 1,400 feet above sea level, the reduction upward to that level is about 2° and we should expect the mean surface temperature at that elevation to be 32°. Again, Chart IV gives for Cheyenne, Wyo., 30° at sea level. For the altitude of Cheyenne (6,125 feet) the reduction is 9.2°, whence the surface temperatures would be 21°. After this fashion we may now obtain some idea of temperatures for any other portion of the country where no stations are available, provided we know the approximate altitute.

Unsatisfactory as the results may be, this is nevertheless the best that has as yet been done in the way of presenting for general study the average temperature conditions. If we take the other method, plot our observed temperatures on a contour map and draw isotherms that follow the contours quite closely we need a map that must be published on a scale large enough to show the contour lines for every 100 feet, and the location of every station relative thereto. When it comes to the charting of the mean minimum, or mean maximum temperatures, and especially of the individual observed temperatures, we doubt whether any process will be so satisfactory as the simple reproduction of the contour maps with the addition of the actual temperatures charted at the respective stations where one can study them in connection with winds and orography. The study of local climatology, local rains, local storms and winds is and must be most unsatisfactory until detailed topographic maps are at hand.

REQUEST.

It is desired to obtain some copies of the work entitled Professional Papers of the Signal Service, No. 1. Report on the Solar Eclipse of July, 1878; by Cleveland Abbe. Washington, 1881. 4to. 186 pp. 28 wood cuts. Any one who has a copy to spare should confer with the Editor.